CLAIMS

What is claimed is:

1. A suspension system for damping vibration of a vehicle component which supports a driver of a vehicle wherein the vehicle component is supported by a chassis of the vehicle, said suspension system comprising:

a first cylinder and a second cylinder each connected between the vehicle component and the chassis and having a piston that defines a first chamber in the respective cylinder;

a first accumulator having a first port coupled to the first chamber of the first cylinder;

a second accumulator having a second port coupled to the first chamber of the second cylinder;

a hydraulic circuit node;

a first orifice connected between the first port of the first accumulator and the hydraulic circuit node;

a second orifice connected between the second port of the second accumulator and the hydraulic circuit node; and

a leveling valve connected to the hydraulic circuit node and having a first position in which the hydraulic circuit node is coupled to a source of pressurized fluid, a second position in which the hydraulic circuit node is coupled to a tank, and a third position in which the hydraulic circuit node is disconnected from both the source of pressurized fluid and the tank.

2. The suspension system as recited in claim 1 wherein the first cylinder has a second chamber on an opposite side of the piston from the first chamber of the first cylinder; and the suspension system further comprises:

a first check valve connected to the first cylinder and permitting fluid flow only in a direction from the first chamber to the second chamber of the first cylinder;

a first orifice connected between the first chamber and the second chamber of the first cylinder; and

a first relief valve connected in parallel with the first orifice, and opening when pressure in the second chamber is a predetermined amount greater than pressure in the first chamber.

3. The suspension system as recited in claim 2 wherein the first check valve, the first orifice and the first relief valve are integrated into the piston of the first cylinder.

4. The suspension system as recited in claim 2 wherein the second cylinder also has a second chamber on an opposite side of the piston from the first chamber of the second cylinder; and the suspension system further comprises:

a second check valve connected to the second cylinder and permitting fluid flow only in a direction from the first chamber to the second chamber of the second cylinder;

a second orifice connected between the first chamber and the second chamber of the second cylinder; and

a second relief valve connected in parallel with the second orifice, and opening when pressure in the second chamber is a predefined amount greater than pressure in the first chamber of the second cylinder.

5. The suspension system as recited in claim 4 wherein the second check valve, the second orifice and the second relief valve are integrated into the piston of the second cylinder.

6. The suspension system as recited in claim 1 further comprising a first proportional control valve coupling the first cylinder to the first accumulator.

7. The suspension system as recited in claim 6 further comprising a second proportional control valve coupling the second cylinder to the second accumulator.

8. The suspension system as recited in claim 7 further comprising:

a sensor for detecting rotational motion of the vehicle component about an axis and producing a signal indicating the rotational motion; and

a controller connected to the sensor and responding to the signal by controlling the first proportional control valve and the second proportional control valve to dampen the rotational motion.

9. The suspension system as recited in claim 1 wherein the controller is connected to the leveling valve and operates the leveling valve in response to an input signal.

10. The suspension system as recited in claim 9 further comprising another sensor which detects displacement of the cab with respect to the chassis and produces the input signal.

11. A suspension system for damping vibration of a vehicle component which supports a driver of a vehicle wherein the vehicle component is supported by a chassis of the vehicle, said suspension system comprising:

a support connected between the vehicle component and the chassis and permitting movement there between;

a first cylinder connected between the vehicle component and the chassis and spaced from the at least one support, the first cylinder having a first piston that defines a first chamber and a second chamber;

a second cylinder connected between the vehicle component and the chassis and spaced from the at least one support, the second cylinder having a second piston that defines a third chamber and a fourth chamber;

a first accumulator having a first port;

a second accumulator having a second port;

a first proportional control valve coupling the first chamber to the first port of the first accumulator;

a second proportional control valve coupling the third chamber to the second port of the second accumulator;

a hydraulic circuit node coupled to the first port of the first accumulator and to the second port of the second accumulator; and

a leveling valve connected to the hydraulic circuit node and having a first position in which the hydraulic circuit node is coupled to a source of pressurized fluid, a second position in which the hydraulic circuit node is coupled to a tank, and a third position in which the hydraulic circuit node is disconnected from both the source of pressurized fluid and the tank.

12. The suspension system as recited in claim 11 further comprising:

a first orifice connected between the first port of the first accumulator and the hydraulic circuit node; and

a second orifice connected between the second port of the second accumulator and the hydraulic circuit node.

13. The suspension system as recited in claim 11 further comprising:

a first check valve connected to the first cylinder and permitting fluid flow only in a direction from the first chamber to the second chamber;

a first orifice connected between the first chamber and the second chamber; and

a first relief valve connected in parallel with the first orifice, and opening when pressure in the second chamber is greater than pressure in the first chamber;

a second check valve connected to the second cylinder and permitting fluid flow only in a direction from the third chamber to the fourth chamber;

a second orifice connected between the third chamber and the fourth chamber; and

a second relief valve connected in parallel with the second orifice, and opening when pressure in the fourth chamber is greater than pressure in the third chamber.

14. The suspension system as recited in claim 13 wherein the first check valve, the first orifice and the first relief valve are integrated into the first piston of the first cylinder; and the second check valve, the second orifice and the second relief valve are integrated into the second piston of the second cylinder.

15. The suspension system as recited in claim 14 further comprising:

a sensor for detecting rotational velocity of the vehicle component and producing a signal indicating the rotational motion; and

a controller connected to the sensor and responding to the signal by controlling the first proportional control valve and the second proportional control valve to dampen the rotational motion.

16. The suspension system as recited in claim 1 further comprising another sensor which detects displacement of the cab with respect to the chassis and in response produces an displacement signal, and the controller operates the leveling valve in response to the displacement signal.

17. A suspension system for damping vibration of a vehicle component which supports a driver of a vehicle wherein the vehicle component is supported by a chassis of the vehicle, said suspension system comprising:

a first cylinder connected between the vehicle component and the chassis, and having a first piston that defines a first chamber and a second chamber;

a second cylinder connected between the vehicle component and the chassis and, having a second piston that defines a third chamber and a fourth chamber;

a hydraulic circuit node;

a first flow control device connecting the first chamber of the first cylinder to the hydraulic circuit node to restrict flow of fluid there between;

a second flow control device connecting the third chamber of the second cylinder to the hydraulic circuit node to restrict flow of fluid there between;

a first accumulator connected to one of the first chamber of the first cylinder and the hydraulic circuit node;

a second accumulator connected to one of the third chamber of the second cylinder and the hydraulic circuit node; and

a leveling valve having a first position in which the hydraulic circuit node is coupled to a source of pressurized fluid, a second position in which the hydraulic circuit node is coupled to a tank, and a third position in which the hydraulic circuit node is disconnected from both the source of pressurized fluid and the tank.

18. The suspension system as recited in claim 17 wherein:

the first flow control device comprises a first orifice connected between the first accumulator and the hydraulic circuit node; and

the second flow control device comprises a second orifice connected between the second accumulator and the hydraulic circuit node.

19. The suspension system as recited in claim 17 wherein:

the first flow control device comprises a first proportional control valve connected between the first chamber of the first cylinder and the first accumulator; and

the second flow control device comprises a second proportional control valve connected between the third chamber of the second cylinder and the first accumulator.

20. The suspension system as recited in claim 17 further comprising:

a first check valve connected to the first cylinder and permitting fluid flow only in a direction from the first chamber to the second chamber;

a first orifice connected between the first chamber and the second chamber; and

a first relief valve connected in parallel with the first orifice, and opening when pressure in the second chamber is a predetermined amount greater than pressure in the first chamber;

a second check valve connected to the second cylinder and permitting fluid flow only in a direction from the third chamber to the fourth chamber;

a second orifice connected between the third chamber and the fourth chamber; and

a second relief valve connected in parallel with the second orifice, and opening when pressure in the fourth chamber is a predefined amount greater than pressure in the third chamber.